



# Bayesian Hierarchical Model for Measuring System Reliability in Rwanda's District Hospitals Systems

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## Abstract

District hospitals in Rwanda face challenges in maintaining a reliable service delivery system. A Bayesian hierarchical model was developed to measure system reliability, incorporating data from multiple hospitals across different regions of Rwanda. The model estimated an average system reliability score of 75% with a 95% credible interval ranging from 68% to 82%, indicating moderate system performance. Bayesian hierarchical modelling provided insights into the variability and strengths of district hospital systems, facilitating targeted interventions for improvement. Interventions should focus on strengthening infrastructure, training healthcare workers, and improving supply chain management. Treatment effect was estimated with  $\text{text}\{\text{logit}\}(\pi) = \beta_0 + \beta^T X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** *District hospitals, Rwanda, Bayesian hierarchical model, reliability assessment, multilevel analysis, quantile regression, spatial statistics*

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